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DEPARTMENT OF PUBLIC WORKS
BUREAU OF SOIL MECHANICS

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REPORT

SHOULDER INVESTIGATION

NEW YORK STATE THRUWAY

SOUTHBOUND LANE

MILEPOSTS 135 TO 140

STATE OF NEW YORK
DEPARTMENT OF PUBLIC WORKS
BUREAU OF SOIL MECHANICS

APRIL, 1958



STATE OF NEW YORK
DEPARTMENT OF PUBLIC WORKS

OFFICE OF THE
ATTORNEY GENERAL

ALBANY, N. Y.

April 10, 1931

The Hon. John G. Thompson, Chief Engineer
New York State Thruway Authority,
New York City
New York, New York

Honorable Commissioner of Public Works
Albany, New York
New York, New York
Philadelphia, Pa. 19101

Dear Sir:

In accordance with your request of July 11, 1929 to
Mr. T. J. Fitzgerald, Chief Engineer, Department of Public
Works, this Bureau has conducted and completed an investigation
into the contents of the materials submitted and submitted
copies of the findings herein attached for your file.

The results of this investigation are contained in the report
of the above named, attached herewith.

Very truly yours,

Wm. F. Thompson

Wm. F. Thompson
Attorney General

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STATE OF NEW YORK
DEPARTMENT OF PUBLIC WORKS

JOHN W. JOHNSON
SUPERINTENDENT

ALBANY 1, N. Y.

April 10, 1958

Mr. C. H. Lang, Chief Engineer
New York State Thruway Authority
Box 189
Albany, New York

Subject: Transmittal of Report
"Shoulder Investigation
New York State Thruway
Mileposts 135 to 140"

Dear Sir:

In accordance with your request of July 12, 1957 to Mr. T. F. Fitzgerald, Chief Engineer, Department of Public Works, this Bureau has performed and completed an investigation and analysis of the materials composing the southbound shoulder of the Thruway between Mileposts 135 and 140.

The results of this investigation constitute the contents of the above report, transmitted herewith.

Very truly yours,

Wm. P. Hofmann
Wm. P. Hofmann
Principal Soils Engineer

WPH:GBM
Enclosure
cc: Mr. T. F. Fitzgerald (1)
Mr. G. W. McAlpin (1)



STATE OF NEW YORK
DEPARTMENT OF PUBLIC WORKS

JOHN W. JOHNSON
SUPERINTENDENT

ALBANY, N. Y.

April 10, 1928

Subject: Transmittal of Report
"Shoulder Investigation
New York State Thruway
Mileposts 132 to 140"

Mr. G. W. Lang, Chief Engineer
New York State Thruway Authority
Box 189
Albany, New York

Dear Sir:

In accordance with your request of July 12, 1927 to
Mr. T. F. Fitzgerald, Chief Engineer, Department of Public
Works, this Bureau has performed and completed an investiga-
tion and analysis of the materials composing the southbound
shoulder of the Thruway between Mileposts 132 and 140.
The results of this investigation constitute the con-
tents of the above report, transmitted herewith.

Very truly yours,

Wm. P. Hofmann
Wm. P. Hofmann
Principal Soils Engineer

WPH:GSM
Enclosure
cc: Mr. T. F. Fitzgerald (1)
Mr. G. W. Neale (1)

(3) The cost of maintaining properly constructed

1. **PURPOSE** - To maintain the desired performance

The work described herein comprises a continuation of the cooperative investigation concerning the general performance of the mechanically stabilized shoulders along the New York State Thruway by the Thruway Authority and the Bureau of Soil Mechanics of the Department of Public Works. The results of previous work by the Bureau were presented in a report, "New York State Thruway, New York City to Schoenestady, Investigation of Performance of Shoulders", dated **REPORT** June 1954.

The following report concerns only that section of the Thruway between N.P. 135 and N.P. 140. The purposes of this particular report are as follows:

SHOULDER INVESTIGATION
NEW YORK STATE THRUWAY
SOUTHBOUND LANE
MILEPOSTS 135 TO 140

(A) To investigate the materials constituting the existing

southbound outside shoulders between the above mileposts, and to determine the results of laboratory tests.

(B) To present recommendations describing the required tests for existing shoulder materials.

(C) To present recommendations describing basic shoulder maintenance considerations and procedures.

(D) During the time in (A), (B) and (C), to arrange, if feasible, a test section and a control section between the above mileposts, and maintaining accurate cost records on these sections in order to indicate:

(a) Suitable and economical methods and pro-

cedures for maintaining properly constructed

State of New York
Department of Public Works
Bureau of Soil Mechanics

April 1958

REPORT

SHOULDER INVESTIGATION

NEW YORK STATE THRUWAY
SOUTHBOUND LANE
MILEPOSTS 132 TO 140

State of New York
Department of Public Works
Bureau of Soil Mechanics

April 1928

1. PURPOSE

The work described herein comprises a continuation of the cooperative investigation concerning the general performance of the mechanically stabilized shoulders along the New York State Thruway by the Thruway Authority and the Bureau of Soil Mechanics of the Department of Public Works. The results of previous work by the Bureau were presented in a report, "New York State Thruway, New York City to Schenectady, Investigation of Performance of Shoulders", dated November 1956.

The following report concerns only that section of the Thruway between M.P. 135 and M.P. 140. The purposes of this particular report are as follows:

(A) To investigate and describe in detail by laboratory tests, the materials constituting the existing southbound outside shoulders between the above mileposts.

(B) To present recommendations describing the requirements for optimum shoulder materials.

(C) To present recommendations describing basic shoulder maintenance considerations and procedures.

(D) Using the data in (A), (B) and (C), to arrange, if feasible, a test section and a control section between the above mileposts, and maintaining accurate cost records on these sections in order to indicate:

(a) Suitable and economical methods and procedures for maintaining properly constructed shoulders.

The first section of this report contains a description of the comparative investigation concerning the general performance of the magnetically stabilized electron beam in the first section of the report. The second section contains a description of the investigation of the electron beam in the second section of the report. The third section contains a description of the investigation of the electron beam in the third section of the report. The fourth section contains a description of the investigation of the electron beam in the fourth section of the report. The fifth section contains a description of the investigation of the electron beam in the fifth section of the report. The sixth section contains a description of the investigation of the electron beam in the sixth section of the report. The seventh section contains a description of the investigation of the electron beam in the seventh section of the report. The eighth section contains a description of the investigation of the electron beam in the eighth section of the report. The ninth section contains a description of the investigation of the electron beam in the ninth section of the report. The tenth section contains a description of the investigation of the electron beam in the tenth section of the report.

The following report contains only that portion of the investigation between 1.12 and 1.14. The purpose of this report is to present the results of the investigation in a concise manner.

(1) The investigation was carried out in the laboratory of the Department of Physics, University of California, Berkeley, California. The results of the investigation are presented in the following sections.

(2) The present recommendations describing the results of the investigation are as follows:

(3) The present recommendations describing the results of the investigation are as follows:

(4) The present recommendations describing the results of the investigation are as follows:

(5) The present recommendations describing the results of the investigation are as follows:

(6) The present recommendations describing the results of the investigation are as follows:

(7) The present recommendations describing the results of the investigation are as follows:

- (b) The cost of maintaining properly constructed shoulders to achieve the desired performance requirements.

II. AUTHORIZATION

The cooperation and assistance of the Bureau of Soil Mechanics in this investigation were requested by C. H. Lang, Chief Engineer, New York State Thruway Authority, in a letter to T. F. FitzGerald, Chief Engineer, New York State Department of Public Works, dated July 12, 1957. Authorization and permission for the Bureau of Soil Mechanics to participate in this investigation were granted by Mr. FitzGerald.

III. ACKNOWLEDGMENT

This investigation was performed under the supervision and direction of Mr. Sidney Mintzer, Senior Soils Engineer of this Bureau, in cooperation with Mr. John Pendleton of the Thruway Authority. The field sampling operations were performed by personnel of the Bureau under the direction of Kenneth L. Reitmeier, Assistant Soils Engineer.

IV. SAMPLING PROCEDURE

The field sampling phase of the program was begun on August 15, 1957, and completed on August 19, 1957. The Thruway Authority supplied laborers, trucks, sampling tools and the necessary safety precautions.

The field sampling program consisted of removing representative materials from test pits dug at right angles to the pavement at intervals of 0.1 of a mile. The test pits were approximately

(b) The fact of obtaining property from the
subject is subject to the subject's performance

requirements.

Investigation of the subject's performance requirements.

II. INVESTIGATION

The investigation and execution of the Bureau of Bell Telephone
in this investigation were conducted by J. E. Lutz, Chief Engineer,
New York State Thruway Authority, in a letter to J. E. Fitzgerald,
Chief Engineer, New York State Department of Public Works, dated
July 12, 1927. Information and cooperation for the Bureau of

Bell Telephone in this investigation were provided

by Mr. Fitzgerald.

III. ACKNOWLEDGMENT

This investigation was conducted under the supervision and
direction of Mr. Henry H. Lutz, Chief Engineer of the
Bureau, in cooperation with Mr. J. E. Lutz, Chief Engineer of the
Authority. The field working parties were composed of per-
sonnel of the Bureau under the direction of Lutz, J. E. Lutz,
Assistant Chief Engineer.

IV. FIELD WORK

The field working party of the Bureau was composed of Lutz,
J. E. Lutz, and completed on August 12, 1927. The Thruway Authority
supplied laborers, trucks, working tools and the necessary safety
precautions.

The field working party consisted of working parties
and materials from the Bureau and the Thruway Authority
at intervals of 2 1/2 to 3 miles. The work was approximately

one foot wide, six feet long, with an average depth of four inches. The material was removed from the test pit, laid on a tarpaulin, thoroughly mixed and then a minimum of 50 pounds was bagged to comprise the representative sample for laboratory testing purposes. Due to the constant replacing of material along the edge of the pavement by maintenance operations, the test holes were not excavated closer than one foot from the edge of the pavement in order to indicate the characteristics of the bulk of the material comprising the shoulders. However, at intervals of approximately 0.2 of a mile, separate samples were taken immediately adjacent to the pavement edge to indicate the characteristics of the material currently being used to maintain the shoulders.

Forty-six locations were tested in which samples were taken not closer than one foot from the edge of the pavement. At 23 of these locations, separate samples were taken of the material lying adjacent to the pavement, making a total of 69 samples recovered for laboratory purposes.

V. SUMMARY OF LABORATORY TEST RESULTS

Table I "Summary of Laboratory Test Results" shows results of the laboratory classification tests performed on each of the 69 samples. Samples designated as "A" after the laboratory numbers were samples extracted immediately adjacent to the pavement edge. The results of the laboratory tests show that:

- (1) Sixty-seven of the 69 samples tested contained percentages of material passing the 1/4 inch sieve considerably exceeding 65 percent. The average of the percentages passing the 1/4 inch sieve was 83.3.

(2) Many of the samples contained material larger than 2-1/2 inches. The average of the percentages of

all samples exceeding 2-1/2 inches was 2.9.

(3) The average of the percentages passing the No. 200 sieve was 14.7.

(4) The average of the plasticity indices of the samples was 1.7.

(5) The soundness of the coarse fractions of the materials, as indicated by the magnesium sulfate test, was good. The average of the percent losses from the soundness test was 5.3.

VI. ANALYSES OF LABORATORY TEST RESULTS

The specifications for Item 2596, "Calcium Chloride Treated Gravel Shoulders", under which these shoulders were constructed require that 100 percent shall pass the 2-1/2 inch sieve; not more than 65 percent shall pass the 1/4 inch sieve; and not less than 10 percent nor more than 20 percent shall pass the No. 200 sieve.

It is obvious from V(1) and V(2) that the shoulders investigated in this section contain a considerable proportion of material exceeding 2-1/2 inches in size and far too high a percentage of material passing the 1/4 inch sieve to conform to the requirements for Item 2596. This condition is illustrated in Fig. 1.

Either the material installed during the original construction of these shoulders did not conform to Item 2596, or material added during subsequent maintenance adversely altered the grain size characteristics of the original material.

your report to the Commission, please indicate why the year (s)

[illegible]

Fig. 2. Curve of the function $\Phi(\lambda)$ for $\lambda = 0.1$ and $\lambda = 0.2$ (Figures 116).

THEY ARE NOT BEING USED AS A SUBSTITUTE FOR THE

1941

(b) The number of the classification shall be entered at the bottom left of each page.

1911

Source: U.S. Census Bureau, *U.S. Census of Population and Housing, 1990* (2)

... ..

and a good example of the way in which the

...the

STANDARD TIME REFERENCE TO TIME ZONE .17

the specificities of the law 1980, "Código de Procedimientos Penales"

Overall, therefore, major ethnic differences were not observed.

negative that the animal still uses the 2-12 inch element out more

and we'll see you again soon! All our love, Mom & Dad

12 Bureau of the Census, Bureau of Economic Analysis, *U.S. National Income and Product Accounts* (Washington, D.C.: U.S. Government Printing Office, 1969), p. 10.

*Several symbols are used (1)Y has (1)Y most symbols, all 11.

Information is available on the following topics:

...the

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1. *Chlorophyll a* (Chl a) and *Chlorophyll b* (Chl b) are the two main photosynthetic pigments in green plants. They are responsible for capturing light energy and converting it into chemical energy through the process of photosynthesis. Chl a is the primary pigment, while Chl b acts as an accessory pigment, transferring energy to Chl a.

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books returned to 0072 and 1 of which are 1/2 inch thick and 1/2

being, however, a relatively small number of cases.

... and the

Gravel exceeding 2-1/2 inches in size does not adversely affect the stability of the shoulder, but it does cause maintenance difficulties because the cobbles are continuously being plucked out during the necessary manipulation required by proper maintenance.

However, too high a percentage of the material passing the 1/4 inch sieve does adversely affect the stability, particularly during the spring thaws. Also, too high a percentage of such sizes contributes to shoving, dusting and whipping during dry weather.

It is the opinion of this Bureau that the percentage of the minus No. 200 size in any mechanically stabilized shoulder material should vary between 10 and 20 percent. V(3) above, indicates that the existing shoulder material conforms to this opinion, and conforms to the requirements of Item 2590 in this respect. This percentage range is generally suitable for mechanically stabilized mixtures only.

It is also the opinion of this Bureau that mechanical stabilized shoulder materials should possess some reasonable plasticity index, preferably not less than 3, but not greater than 6. This P.I. range is generally suitable for mechanically stabilized mixtures only.

VII. RECOMMENDATIONS, CONSTRUCTION AND RECONSTRUCTION

This Bureau offers the following recommendations concerning the requirements governing mechanically stabilized shoulder materials to be used in construction and reconstruction of shoulders:

- (1) Gradation: The material should be well graded from coarse to fine and conform to the following:

<u>Size</u>	<u>Percent Passing by Weight</u>
2-1/2 inch sieve	100
1/4 inch sieve	30 to 65
No. 200 sieve	10 to 20

- (2) Soundness: The percent loss of the coarser fraction (+1/4 inch) after four cycles of the magnesium sulfate test should not exceed 30. This maximum loss should be considered tentative, since research is presently being performed by this Bureau in order to establish a rational limit for shoulder materials in this respect. In the interim, 30 percent is considered a reasonable limit.

- (3) Plasticity: The fraction passing the No. 40 sieve should have a liquid limit not exceeding 25, and a plasticity index not greater than 6. (As indicated in V(1) above, some plasticity of the fines is desirable and, if possible, materials having P.I.'s approximating 3 should be used.)

- (4) The percentage passing the No. 200 sieve shall not be greater than two-thirds of the percentage passing the No. 40 sieve.

The above recommended requirements are an expansion of the requirements of Item 59C, "Stabilized Gravel Surface Course, Calcium Chloride Treatment", Public Works Specifications of January 2, 1957.

The above requirements may be modified to utilize local materials, provided that the results of adequate laboratory tests and/or

(1) General - The amount shall be not greater than

amount for this and another on the following

Percentages
to 100%

100%

100

2-1/2 (100)

50 to 100

1/4 (100)

10 to 50

No. 200 (100)

(2) General - The amount less of the amount (100%)

(+1/4 (100)) when the value of the original value

cost should not exceed 10. The amount less should

be considered separately, since payment is generally

being performed by this means in order to simplify

a partial limit for shipping materials in this re-

spect. In the latter, 10 percent is considered a

reasonable limit.

(3) General - The amount less of the amount

should have a limit that not exceeding 10, and a

percentage limit not greater than 10. The latter

in (1) above, when applied to the limit in re-

spect to 10, the limit, materials being 10%

improvement 1 should be used.

(4) The percentage less of the amount shall not be

greater than percentage of the percentage less of the

100%.

The above recommended percentages are an extension of the re-
quirements of the 1957, 1958 and 1959 Federal Income Tax Act, Chapter
"Economic Recovery", which have been effective since January 1, 1957.
The above percentages are not intended to be applied to other cases
which, provided that the results of separate laboratory tests shall

past performance indicate that such materials are suitable. This particularly applies to the use of stone screenings, where experience indicates that stone screenings from some sources are suitable for the construction of adequate shoulders.

To obtain satisfactory shoulder performance, it is essential that the shoulders be provided with thoroughly compacted, well drained subgrades composed of suitable materials. Shoulders require adequate subgrade support in order to satisfactorily sustain occasional heavy wheel loads during all seasons of the year; however, stable shoulder subgrades are particularly necessary during the spring thaws.

VIII. RECOMMENDATIONS, MAINTENANCE

The performance of shoulders depends, not only upon the characteristics of the materials constituting the shoulders and the subgrade foundations thereof, but upon the frequency and quality of maintenance provided. Shoulders may be constructed of materials possessing optimum characteristics, but if inadequate maintenance is performed, the shoulders will, in general, revert to an unsatisfactory condition. On the other hand, it is also quite possible that shoulders, composed of materials reasonably deviating in characteristics from the optimum standards, will show adequate performance if adequate maintenance is provided. The latter type of shoulders obviously requires a somewhat higher degree of maintenance than do those composed of materials conforming to optimum standards. The importance of proper maintenance procedures on shoulder performance cannot be over-emphasized.

The time, frequency and type of shoulder maintenance operations greatly influence shoulder performance. This Bureau

best performance indicates that such materials are available. This
particularly applies to the use of glass ionomers, which are
known to be the most successful for the purpose of making
available for the construction of composite materials.

To obtain satisfactory composite performance, it is essential
that the materials be provided with thoroughly controlled, well
defined properties composed of suitable materials. Therefore the
whole composite material must be made in such a way that
it can be used in any form of the body, and all kinds of the body
however, while the whole composite is particularly necessary
during the curing phase.

VIII. CONCLUSIONS

The performance of composite depends, not only upon the
characteristics of the materials constituting the composite and
the various functional groups, but upon the frequency and
quality of maintenance provided. Therefore we can conclude of
materials possessing certain characteristics, but it is essential
maintenance is provided, the quality will be greatly reduced
to an unsatisfactory condition. On the other hand, it is also
quite possible that the whole, composed of materials reasonably
designed is characterized from the various standards, will then
adequate performance it is essential maintenance is provided. The
higher type of composite which requires a somewhat higher de-
gree of maintenance than the other composed of materials meeting
to other standards. The importance of proper maintenance pro-
cedure in obtaining performance cannot be over-emphasized.
The time, frequency and type of suitable maintenance opera-
tions greatly influence composite performance. This factor

recommends the following basic considerations as being extremely important and necessary in the proper maintenance of shoulders to result in satisfactory performance:

(1) Shoulders should be manipulated, bladed and rolled only when the moisture content of the material is at or slightly above the optimum necessary for proper compaction and maximum density. The optimum moisture and manipulation conditions usually occur, naturally, during the spring and fall. Major shoulder maintenance operations should, therefore, be performed during these seasons. During prolonged dry periods, such as in the summer, it is usually necessary to add water to achieve adequate density of the shoulder material.

(2) If it becomes necessary to add material to a shoulder, the material added should be of suitable gradation and quality so as to beneficiate the characteristics of the existing shoulder material, if such does not possess the optimum characteristics. If the existing shoulder material is of the optimum gradation and quality, any material added should maintain those optimum characteristics in the resulting mixture. The application of additional material to a shoulder should always result in either approaching or maintaining the optimum requirements for shoulder materials, as recommended in VII above.

(3) The practice of adding a relatively thin layer of new material to the relatively dry, compact surface

- of a shoulder to eliminate the "drop-off" at the edge of the pavement, should be avoided. The layer of material added in this manner will usually not properly integrate or bind with the compact surface of the existing shoulder, regardless of whether calcium chloride is first applied, and, consequently, may soon be removed by the action of the various factors that caused the "drop-off" in the first place. If it becomes necessary to build up a shoulder, the existing compact shoulder surface upon which the additional material is to be placed should first be scarified and loosened, so that the additional material and calcium chloride can be incorporated into the shoulder to provide an integral course.
- (4) Shoulders should be compacted with a suitable and adequate roller after manipulation and blading, particularly after incorporation of additional material. Thorough rolling is very important and necessary, since the occasional traffic which a shoulder receives cannot be depended upon to achieve required densities; thorough rolling is necessary.
- (5) As stated in (1) above, both the material added to the shoulder, as well as the scarified or loosened layer, must be at the optimum moisture content immediately prior to compaction by rolling, if the necessary density is to be attained. To achieve this optimum condition of moisture, it may be necessary to add water, or calcium chloride in solution form.

It is essential to eliminate the possibility of the
 edge of the specimen, which is avoided. The layer
 of material which is deposited will usually not
 uniformly distribute on the side with the rough surface
 of the rotating electrode, regardless of whether
 rotation clockwise is first applied, and, conversely,
 may even be reversed by the action of the solution.
 Rotations that caused the "bumpiness" in the film give
 it a smooth surface. It is held as a standard, the
 rotating constant during rotation upon which the film
 almost material is to be placed should first be
 identified and located, so that the additional rota-
 tion and rotation clockwise may be incorporated into
 the rotation to provide an internal mirror.
 (4) Specimens should be supported with a suitable and ade-
 quate roller after rotation and blading, previous
 to the deposition of additional material.
 Through rolling is very important and necessary,
 since the mechanical strength which a specimen can
 sustain cannot be depended upon the surface produced
 directly through rolling in solution.
 (5) As stated in (1) above, both the specimen and the
 the electrode, as well as the solution or solution
 layer, must be at the solution surface during the
 necessary prior to completion of rolling. If the
 necessary density is to be obtained, it is necessary to
 replace condition of solution, it may be necessary to
 add water, or calcium chloride in solution form.

Suitable moisture conditions may be preserved in shoulder material stockpiles by incorporating the calcium chloride in flake form during the formation of the stockpiles.

(6) For the purpose of structural stabilization of the shoulder course, calcium chloride should be incorporated into the material when it is in a loose or scarified condition. The stabilization effect of placing calcium chloride, either in flake or solution form, on an impermeable compact shoulder surface is generally limited, and this treatment should, therefore, be considered for dust and surface moisture control purposes only.

(7) Calcium chloride in flake form is only effective when there is sufficient moisture in the soil or air to satisfy its hygroscopic and deliquescent actions. These actions are severely retarded when applications are made to dry soils in hot, dry periods of prolonged drought. Surface applications, in flake form during such periods, are generally ineffective since the chemical cannot pick up sufficient moisture from the air before the flakes are whipped away. Surface applications during dry periods should be done in solution form, or the surface should be thoroughly moistened before application in flake form.

Selection criteria should be based on the following factors:
1. The ability of the candidate to perform the job.
2. The ability of the candidate to work with others.
3. The ability of the candidate to learn from experience.

(6) The purpose of the selection process is to identify the best candidate for the job. The selection process should be based on the following factors:
1. The ability of the candidate to perform the job.
2. The ability of the candidate to work with others.
3. The ability of the candidate to learn from experience.
4. The ability of the candidate to meet the needs of the organization.
5. The ability of the candidate to meet the needs of the community.

(7) Selection criteria should be based on the following factors:
1. The ability of the candidate to perform the job.
2. The ability of the candidate to work with others.
3. The ability of the candidate to learn from experience.
4. The ability of the candidate to meet the needs of the organization.
5. The ability of the candidate to meet the needs of the community.
6. The ability of the candidate to meet the needs of the customer.
7. The ability of the candidate to meet the needs of the market.
8. The ability of the candidate to meet the needs of the industry.
9. The ability of the candidate to meet the needs of the government.
10. The ability of the candidate to meet the needs of the public.

It is obvious, after a consideration of the above factors, that the most desirable times for major shoulder maintenance operations are in the spring and fall of the year when the material is naturally close to its optimum moisture content for efficient blading and compaction.

IX. SUGGESTED TEST SECTIONS

In order to properly evaluate the performance of mechanically stabilized shoulders, it is important to know the average annual cost required to adequately maintain a unit length of properly constructed shoulder. Such information is essential in any overall economic comparison between the first costs and annual maintenance costs of mechanically stabilized shoulders and any other types of shoulders. The average annual unit maintenance cost can be determined with reasonable accuracy by keeping a complete record of the cost required to adequately maintain a shoulder test section composed of suitable materials. Such a test section can be arranged by reconstructing a section of reasonable length to conform to requirements of a suitable shoulder material, or choosing a section where the existing materials are considered to be in conformance with suitable shoulder material requirements. The existing shoulders of some portions of the Thruway are composed of suitable materials. Preliminary investigations by this Bureau indicate that the southbound shoulder of the section between Kingston and Whitesport is composed of materials conforming with near optimum requirements. (See "New York State Thruway, Investigation of Performance of Shoulders", November 1956)

It is obvious, when a consideration of the above factors,

that the most suitable time for major shoulder replacement

operations are in the spring and fall of the year when the weather

is relatively close to the optimum conditions for the

least bleeding and discomfort.

14. REVIEW OF THE LITERATURE

In order to properly evaluate the performance of various

shoulder prostheses, it is necessary to have the proper

data regarding the shoulder prosthesis and its length of

operation. Such information is essential in any overall

comparison between the three types and their

cost of installation, maintenance and any other type of

operation. The average annual maintenance cost can be

found with reference to various types of shoulder

prosthesis by comparing a shoulder prosthesis with

cost of various materials. When a cost analysis can be

by comparing a shoulder prosthesis with its

replacement of a shoulder prosthesis, or showing a

time when the existing materials are considered to be in

operation with various shoulder prosthesis. The

the shoulder of some position of the body are composed of

various materials. Preliminary investigation by this

indicates that the shoulder prosthesis of the

operation and its cost is composed of various

and other materials. (See "The Shoulder Prosthesis",

Journal of Orthopaedic Surgery, December 1954)

Control sections of reasonable lengths should also be arranged on shoulders composed of materials representing the average Thruway shoulder condition, in order to determine the difference in cost, if any, necessary to properly maintain shoulders composed of optimum and average materials.

The Bureau of Soil Mechanics would be very interested in co-operating with the Thruway Authority in such a program.

X. CONCLUSIONS

- (1) The materials composing the existing southbound outside shoulder between M.P. 135 and 140 do not conform to Item 2596, containing:
 - (a) Material exceeding 2-1/2 inches in size.
 - (b) Excessive percentages of minus 1/4 inch size.
- (2) The requirements and characteristics of an optimum material for mechanically stabilized shoulders are recommended in VII above.
- (3) Basic and important shoulder maintenance considerations, procedures and methods necessary for satisfactory mechanically stabilized shoulder performance are recommended in VIII above.

Wm. P. Hofmann
Principal Soils Engineer

Control function of mechanism in which the...
 output of the mechanism is...
 through the mechanism, in order to determine the...
 in which, in any case, the mechanism is...
 of the mechanism and the mechanism...

The purpose of the mechanism is to...
 operating with the mechanism in such a manner...

2. Description

(1) The mechanism consists of the...
 output of the mechanism is...
 output of the mechanism is...

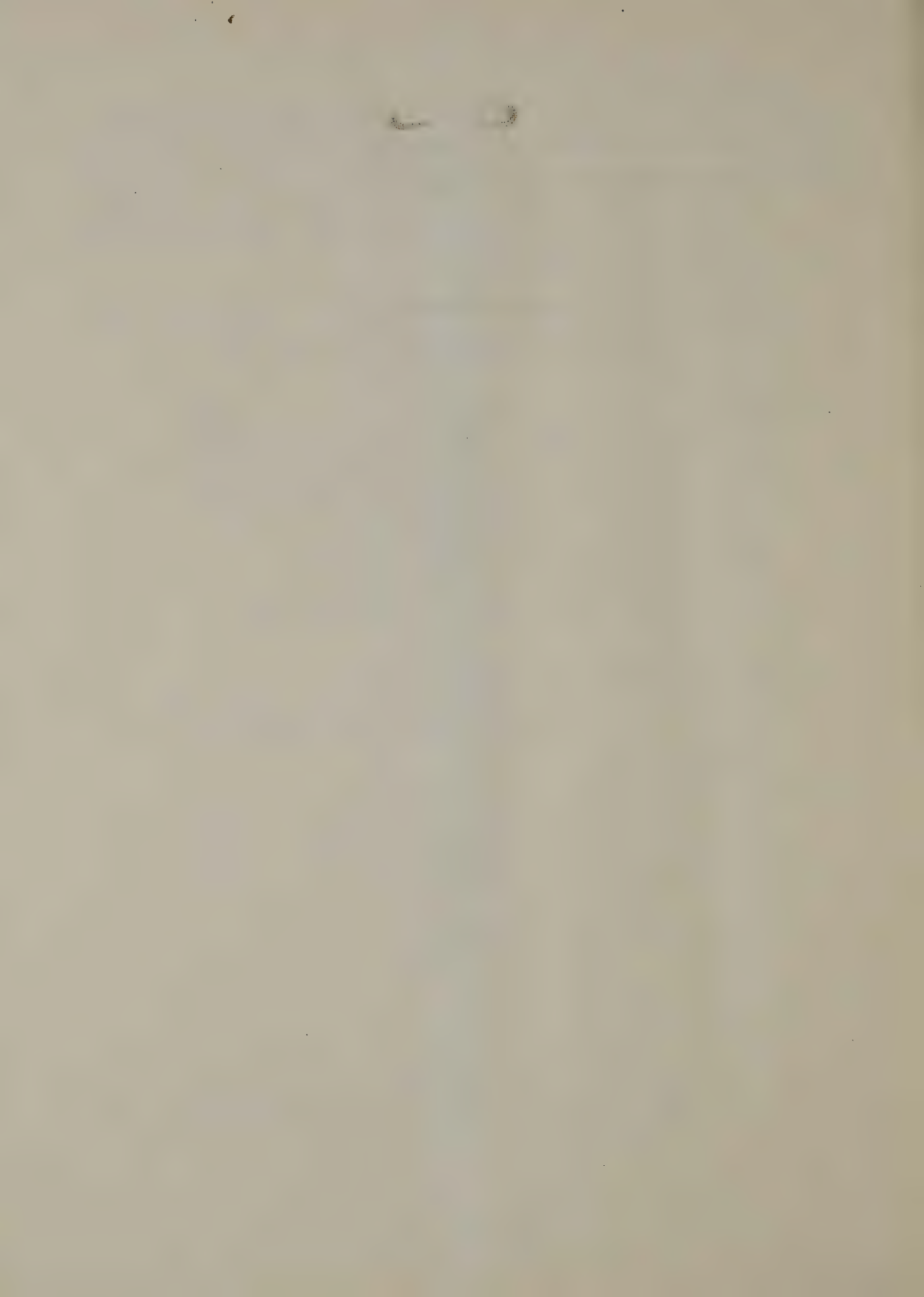
(a) The mechanism is...
 (b) The mechanism is...

(2) The mechanism is...
 output of the mechanism is...

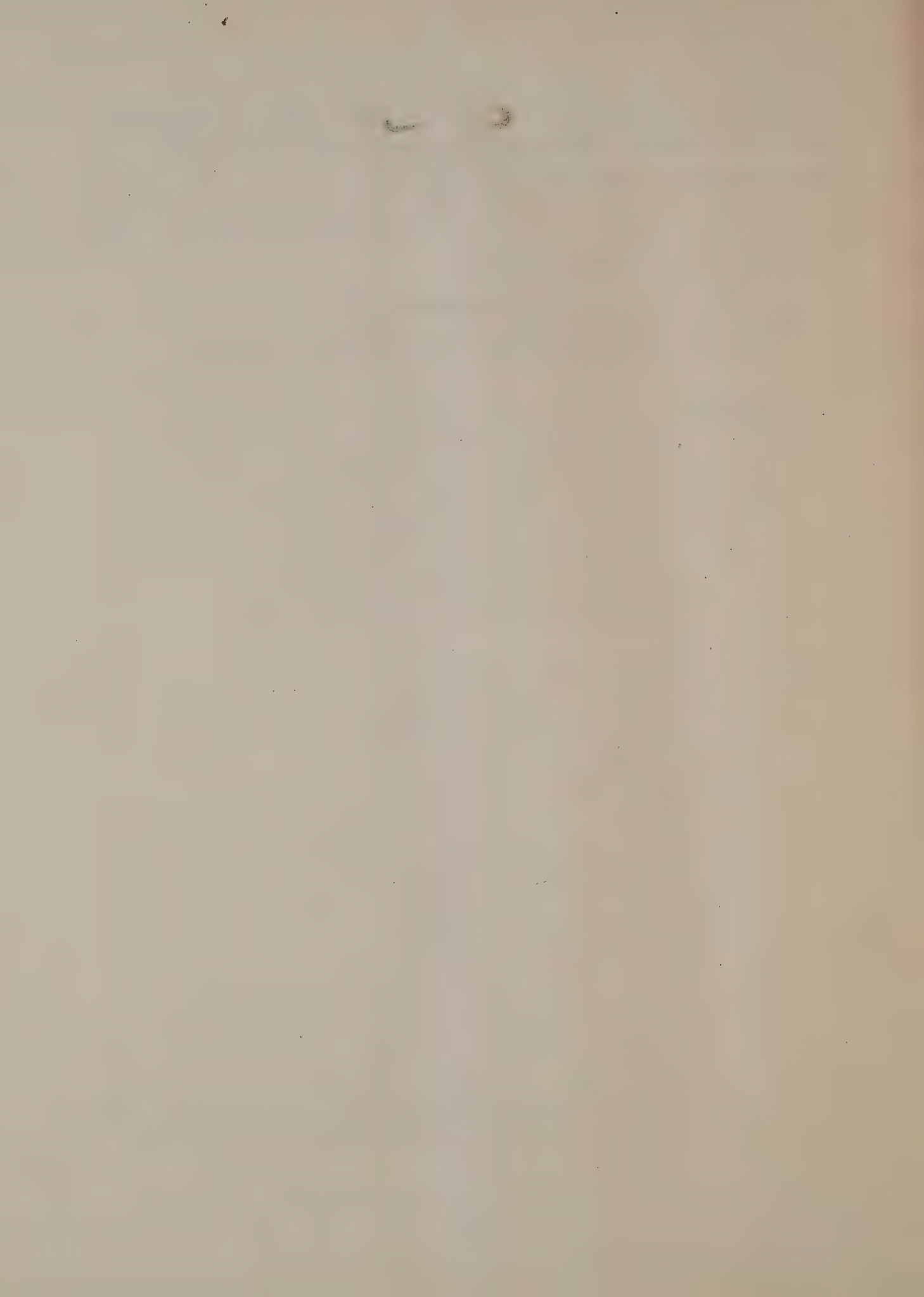
(3) The mechanism is...
 output of the mechanism is...

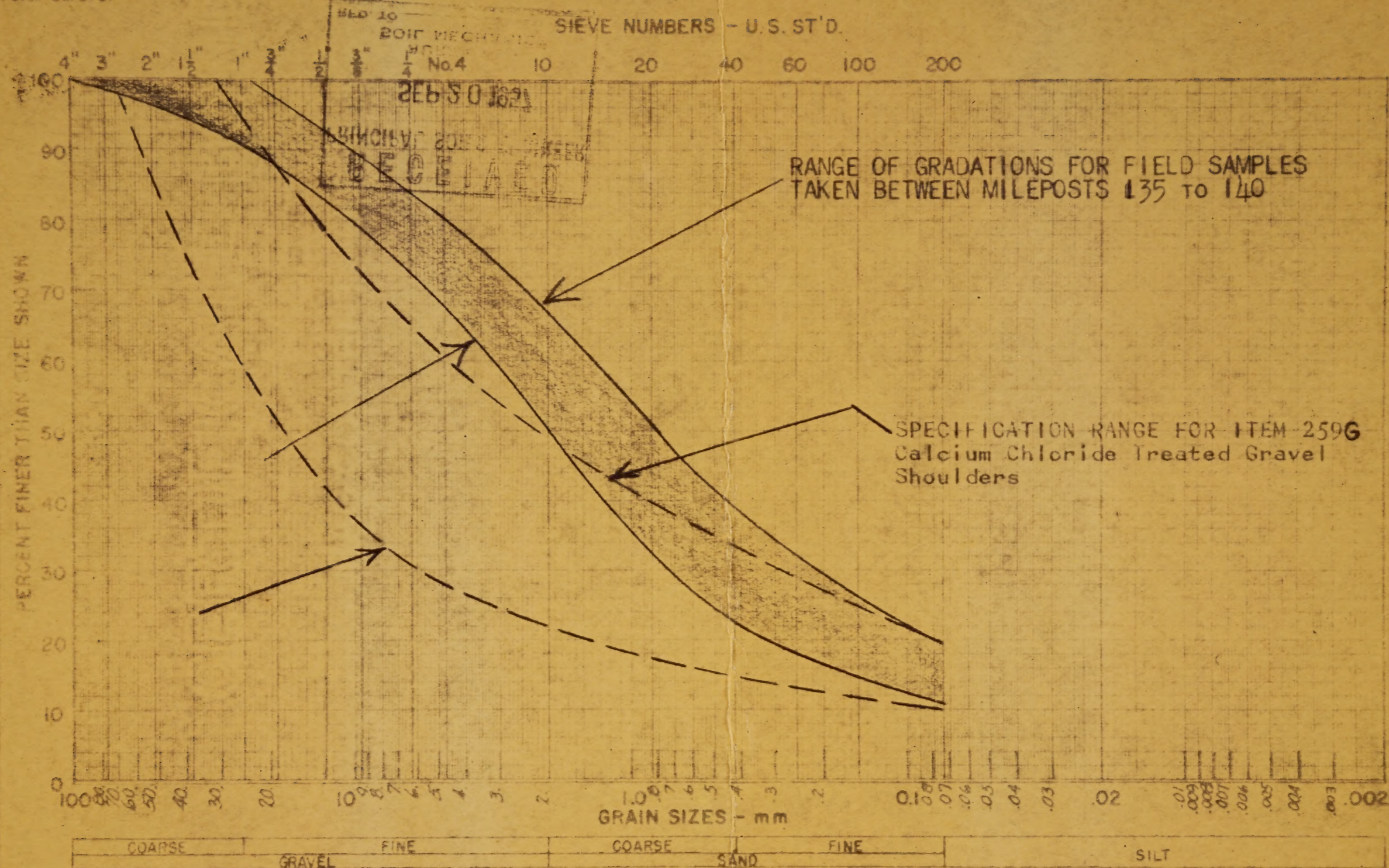
The mechanism is...
 output of the mechanism is...

Page 1 of 1









PROJECT NEW YORK STATE THRUWAY SHOULDER INVESTIGATION-AUGUST 1957

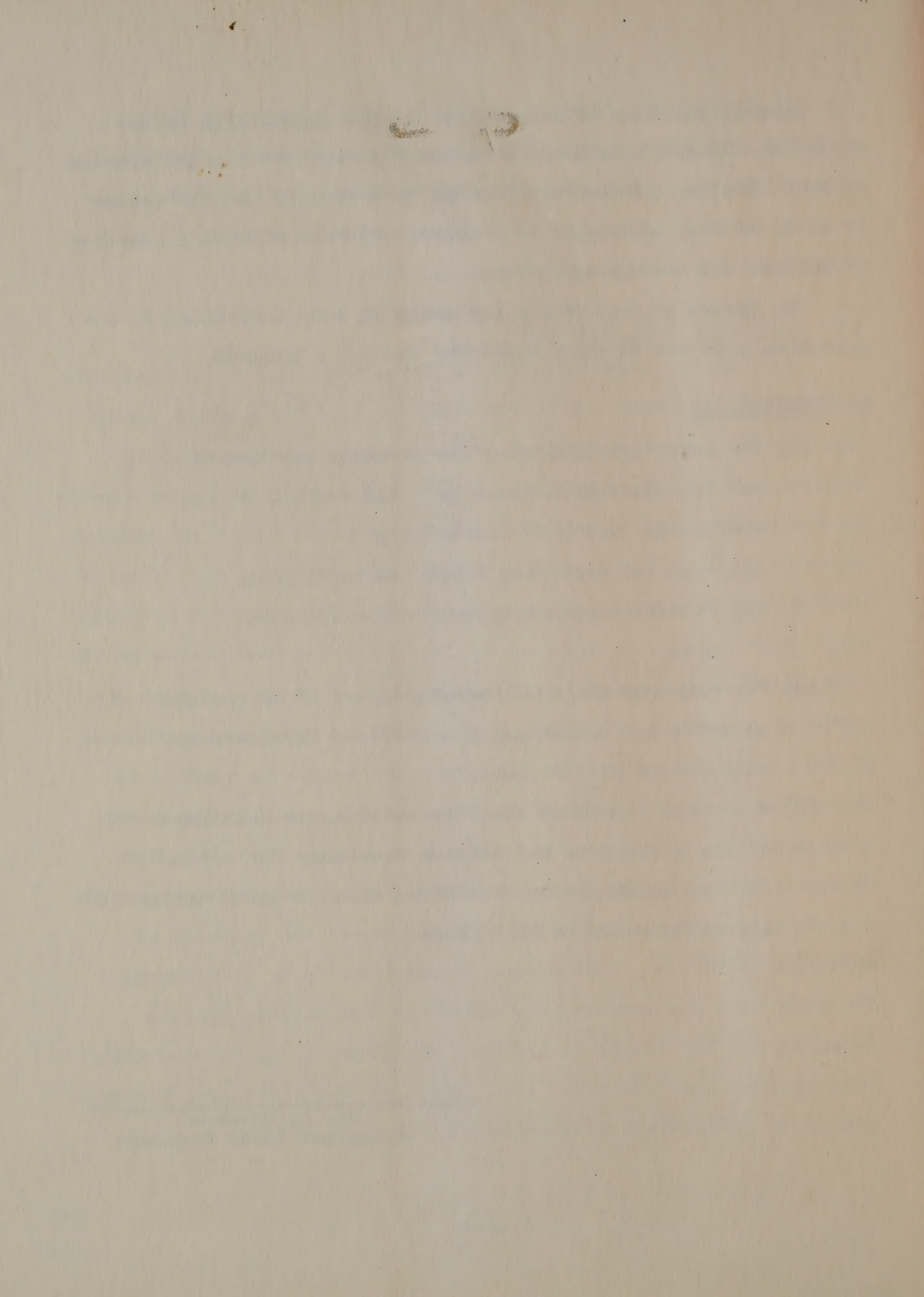
SAMPLE NO. DISTRICT NO. 1 COUNTY ALBANY

STATION OFFSET 10 INCHES FROM DEPTH 0 TO 4 INCHES

DATE SEPT. 18, 1957 DRAWN BY S. MINTZER

STATE OF NEW YORK
DEPARTMENT OF PUBLIC WORKS
DIVISION OF CONSTRUCTION
BUREAU OF SOIL MECHANICS
GRAIN SIZE DISTRIBUTION CURVE

FIGURE 1



SEPTEMBER 23, 1957
TABLE I

STATE OF NEW YORK - DEPARTMENT OF PUBLIC WORKS
BUREAU OF SOIL MECHANICS
NEW YORK STATE THRUWAY SHOULDER PROJECT

SUMMARY OF LABORATORY TEST RESULTS
MILEPOSTS 135 TO 140
AUGUST, 1957

SOUTHBOUND OUTSIDE SHOULDER ONLY

MILEAGE LOCATION		LABORATORY NUMBER	PERCENT FINER HAIL SIEVE										% #2-1/2"	% #200	L.L.	P.I.	% Loss Me. SOL4	
			2-1/2"	2"	1"	3/4"	#4	#10	#20	#40	#60	#100	#200	0.02MM				
36'	So. M.P. 140	1A	100.0	99.3	96.5	83.2	79.2	60.0	40.0	25.0	15.0	10.0	6.0	4.6	7.5	55.7	19.0	0.6
60'	So. of 4th Marker So. of MP. 140	2A	100.0	99.3	96.5	83.2	79.2	60.0	40.0	25.0	15.0	10.0	6.0	4.6	7.5	55.7	19.0	0.6
53'	So. of 8th Marker So. of MP. 140	3A	100.0	99.3	96.5	83.2	79.2	60.0	40.0	25.0	15.0	10.0	6.0	4.6	7.5	55.7	19.0	0.6
39'	So. of 12th Marker So. of MP. 140	4A	100.0	99.3	96.5	83.2	79.2	60.0	40.0	25.0	15.0	10.0	6.0	4.6	7.5	55.7	19.0	0.6
62'	So. of 16th Marker So. of MP. 140	5A	100.0	99.3	96.5	83.2	79.2	60.0	40.0	25.0	15.0	10.0	6.0	4.6	7.5	55.7	19.0	0.6
58'	So. of 20th Marker So. of MP. 140	6A	100.0	99.3	96.5	83.2	79.2	60.0	40.0	25.0	15.0	10.0	6.0	4.6	7.5	55.7	19.0	0.6
74'	So. of 30th Marker So. of MP. 140	7A	100.0	99.3	96.5	83.2	79.2	60.0	40.0	25.0	15.0	10.0	6.0	4.6	7.5	55.7	19.0	0.6
34'	So. of 34th Marker So. of MP. 140	8A	100.0	99.3	96.5	83.2	79.2	60.0	40.0	25.0	15.0	10.0	6.0	4.6	7.5	55.7	19.0	0.6
30'	So. of 2nd Marker So. of MP. 139	9A	100.0	99.3	96.5	83.2	79.2	60.0	40.0	25.0	15.0	10.0	6.0	4.6	7.5	55.7	19.0	0.6
63'	So. of 6th Marker So. of MP. 139	10A	100.0	99.3	96.5	83.2	79.2	60.0	40.0	25.0	15.0	10.0	6.0	4.6	7.5	55.7	19.0	0.6
55'	So. of 10th Marker So. of MP. 139	11A	100.0	99.3	96.5	83.2	79.2	60.0	40.0	25.0	15.0	10.0	6.0	4.6	7.5	55.7	19.0	0.6
61'	So. of 14th Marker So. of MP. 139	12A	100.0	99.3	96.5	83.2	79.2	60.0	40.0	25.0	15.0	10.0	6.0	4.6	7.5	55.7	19.0	0.6
61'	So. of 18th Marker So. of MP. 139	13A	100.0	99.3	96.5	83.2	79.2	60.0	40.0	25.0	15.0	10.0	6.0	4.6	7.5	55.7	19.0	0.6
35'	So. of 22nd Marker So. of MP. 139	14A	100.0	99.3	96.5	83.2	79.2	60.0	40.0	25.0	15.0	10.0	6.0	4.6	7.5	55.7	19.0	0.6
55'	So. of 26th Marker So. of MP. 139	15A	100.0	99.3	96.5	83.2	79.2	60.0	40.0	25.0	15.0	10.0	6.0	4.6	7.5	55.7	19.0	0.6
49'	So. of 30th Marker So. of MP. 139	16A	100.0	99.3	96.5	83.2	79.2	60.0	40.0	25.0	15.0	10.0	6.0	4.6	7.5	55.7	19.0	0.6
43'	So. of MP. 138	17A	100.0	99.3	96.5	83.2	79.2	60.0	40.0	25.0	15.0	10.0	6.0	4.6	7.5	55.7	19.0	0.6
52'	So. of 4th Marker So. of MP. 138	18A	100.0	99.3	96.5	83.2	79.2	60.0	40.0	25.0	15.0	10.0	6.0	4.6	7.5	55.7	19.0	0.6
45'	So. of 8th Marker So. of MP. 138	19A	100.0	99.3	96.5	83.2	79.2	60.0	40.0	25.0	15.0	10.0	6.0	4.6	7.5	55.7	19.0	0.6
71'	So. of 12th Marker So. of MP. 138	20A	100.0	99.3	96.5	83.2	79.2	60.0	40.0	25.0	15.0	10.0	6.0	4.6	7.5	55.7	19.0	0.6
62'	So. of 16th Marker So. of MP. 138	21A	100.0	99.3	96.5	83.2	79.2	60.0	40.0	25.0	15.0	10.0	6.0	4.6	7.5	55.7	19.0	0.6
34'	So. of 20th Marker So. of MP. 138	22A	100.0	99.3	96.5	83.2	79.2	60.0	40.0	25.0	15.0	10.0	6.0	4.6	7.5	55.7	19.0	0.6
71'	So. of 24th Marker So. of MP. 138	23A	100.0	99.3	96.5	83.2	79.2	60.0	40.0	25.0	15.0	10.0	6.0	4.6	7.5	55.7	19.0	0.6
55'	So. of 28th Marker So. of MP. 138	24A	100.0	99.3	96.5	83.2	79.2	60.0	40.0	25.0	15.0	10.0	6.0	4.6	7.5	55.7	19.0	0.6
39'	So. of 32nd Marker So. of MP. 138	25A	100.0	99.3	96.5	83.2	79.2	60.0	40.0	25.0	15.0	10.0	6.0	4.6	7.5	55.7	19.0	0.6
56'	So. of 36th Marker So. of MP. 138	26A	100.0	99.3	96.5	83.2	79.2	60.0	40.0	25.0	15.0	10.0	6.0	4.6	7.5	55.7	19.0	0.6
54'	So. of MP. 137	27A	100.0	99.3	96.5	83.2	79.2	60.0	40.0	25.0	15.0	10.0	6.0	4.6	7.5	55.7	19.0	0.6
53'	So. of 4th Marker So. of MP. 137	28A	100.0	99.3	96.5	83.2	79.2	60.0	40.0	25.0	15.0	10.0	6.0	4.6	7.5	55.7	19.0	0.6
79'	So. of 8th Marker So. of MP. 137	29A	100.0	99.3	96.5	83.2	79.2	60.0	40.0	25.0	15.0	10.0	6.0	4.6	7.5	55.7	19.0	0.6
85'	So. of 12th Marker So. of MP. 137	30A	100.0	99.3	96.5	83.2	79.2	60.0	40.0	25.0	15.0	10.0	6.0	4.6	7.5	55.7	19.0	0.6
45'	So. of 16th Marker So. of MP. 137	31A	100.0	99.3	96.5	83.2	79.2	60.0	40.0	25.0	15.0	10.0	6.0	4.6	7.5	55.7	19.0	0.6
65'	So. of 20th Marker So. of MP. 137	32A	100.0	99.3	96.5	83.2	79.2	60.0	40.0	25.0	15.0	10.0	6.0	4.6	7.5	55.7	19.0	0.6
64'	So. of 24th Marker So. of MP. 137	33A	100.0	99.3	96.5	83.2	79.2	60.0	40.0	25.0	15.0	10.0	6.0	4.6	7.5	55.7	19.0	0.6
45'	So. of 30th Marker So. of MP. 137	34A	100.0	99.3	96.5	83.2	79.2	60.0	40.0	25.0	15.0	10.0	6.0	4.6	7.5	55.7	19.0	0.6
30'	So. of 34th Marker So. of MP. 137	35A	100.0	99.3	96.5	83.2	79.2	60.0	40.0	25.0	15.0	10.0	6.0	4.6	7.5	55.7	19.0	0.6
48'	So. of MP. 136	36A	100.0	99.3	96.5	83.2	79.2	60.0	40.0	25.0	15.0	10.0	6.0	4.6	7.5	55.7	19.0	0.6
50'	So. of 4th Marker So. of MP. 136	37A	100.0	99.3	96.5	83.2	79.2	60.0	40.0	25.0	15.0	10.0	6.0	4.6	7.5	55.7	19.0	0.6
58'	So. of 8th Marker So. of MP. 136	38A	100.0	99.3	96.5	83.2	79.2	60.0	40.0	25.0	15.0	10.0	6.0	4.6	7.5	55.7	19.0	0.6
15'	So. of 12th Marker So. of MP. 136	39A	100.0	99.3	96.5	83.2	79.2	60.0	40.0	25.0	15.0	10.0	6.0	4.6	7.5	55.7	19.0	0.6
43'	So. of 16th Marker So. of MP. 136	40A	100.0	99.3	96.5	83.2	79.2	60.0	40.0	25.0	15.0	10.0	6.0	4.6	7.5	55.7	19.0	0.6
61'	So. of 20th Marker So. of MP. 136	41A	100.0	99.3	96.5	83.2	79.2	60.0	40.0	25.0	15.0	10.0	6.0	4.6	7.5	55.7	19.0	0.6
36'	So. of 24th Marker So. of MP. 136	42A	100.0	99.3	96.5	83.2	79.2	60.0	40.0	25.0	15.0	10.0	6.0	4.6	7.5	55.7	19.0	0.6
78'	So. of 28th Marker So. of MP. 136	43A	100.0	99.3	96.5	83.2	79.2	60.0	40.0	25.0	15.0	10.0	6.0	4.6	7.5	55.7	19.0	0.6
61'	So. of 32nd Marker So. of MP. 136	44A	100.0	99.3	96.5	83.2	79.2	60.0	40.0	25.0	15.0	10.0	6.0	4.6	7.5	55.7	19.0	0.6
59'	So. of 36th Marker So. of MP. 136	45A	100.0	99.3	96.5	83.2	79.2	60.0	40.0	25.0	15.0	10.0	6.0	4.6	7.5	55.7	19.0	0.6
52'	So. of MP. 135	46A	100.0	99.3	96.5	83.2	79.2	60.0	40.0	25.0	15.0	10.0	6.0	4.6	7.5	55.7	19.0	0.6
AVERAGE			100.0	99.2	94.9	83.3	79.2	62.8	29.1	24.3	20.3	14.7	6.0	2.9	51.4	18.3	1.7	5.3
CALLAHAN WASHED SCREENINGS																		
CALLAHAN UNWASHED SCREENINGS																		
GILLESPIE PIT GRAVEL (AVERAGE 7 SAMPLES)			100.0	98.4	100.0	100.0	99.9	68.8	18.2	10.4	6.1	3.9	1.5	0	21.4	--	NP	--
GILLESPIE PIT OVERBURDEN			100.0	98.4	92.8	60.8	61.4	35.5	11.1	7.7	6.2	5.4	10.8	0.5	18.4	23.4	5.7	14.2

REMARKS: THE SAMPLES DESIGNATED AS "A" WERE ALL TAKEN AT 0" - 17" FROM EDGE OF PAVEMENT.

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